IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Rakowski	
Application Serial No. 10/654,203	
Filing Date: September 3, 2003	OXIDATION RESISTANT FERRITIC STAINLESS STEELS
Art Unit 1733	
Examiner Jessee R. Roe	
Confirmation No. 5809	Attorney Docket No. RL-2000

REPLY BRIEF

December 17, 2010

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Commissioner for Patents
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ATI Properties, Inc., owner of the entire right, title, and interest in the above-identified patent application (the "*Subject Application*"), submits this Reply Brief in accordance with the provisions of 37 C.F.R. § 41.41 in response to the Examiner's Answer issued on October 20, 2010. The Commissioner is hereby authorized to charge PTO Deposit Account No. 11-1110 for any fees necessary for consideration of this reply brief and appeal.

I. STATUS OF CLAIMS

Claims 1-6, 9-11, 13, 14, 16, 18, 20-28, and 99-101 were previously pending in the *Subject Application*. Claims 7, 8, 12, 15, 17, 19, and 29-98 were previously canceled. Claims 6, 14, 23, 24, 27, and 28 were previously withdrawn from consideration.

Claims 11, 13, 14, 16, 18, and 20-28 were canceled without prejudice or disclaimer in an amendment in accordance with 37 C.F.R. § 41.33(b)(1) filed on December 16, 2010. Therefore, claims 1-5, 9-10, and 99-101 remain under examination and on appeal. Claims 1, 10, and 99 are independent claims. Claim 6 remains withdrawn from consideration.

Claims 99-101 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Claims 1-5 and 9-10 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 4,097,311 to Ishibashi et al. ("Ishibashi"). Claims 1-5, 9-10, and 99-101 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Szummer et al., "Hydrogen surface effects in ferritic stainless steels", *J. Alloys and Compounds*, 293-295 (1999), pp. 356-360 ("Szummer") in view of Japan Patent Publication No. 10-280103 to Ono et al. ("Ono"). Claims 1-5, 9-10, and 101 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Szummer in view of International Patent Application Publication No. WO 99/10554 to Linden et al. ("Linden"). Claims 1-5, 9-10, 99 and 101 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Szummer in view of Japan Patent Publication No. 06-172933 to Uematsu et al. ("Uematsu"). Claims 1-5, 9-10, and 101 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Szummer in view of Japan Patent Publication No. 09-209092 to Matsui et al. ("Matsui").

II. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

(1) The rejection of claims 99-101 under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite.

(2) The rejection of claims 1-5 and 9-10 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Ishibashi.

(3) The rejection of claims 1-5, 9-10, and 99-101 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Szummer in view of Ono.

(4) The rejection of claims 1-5, 9-10, 99, and 101 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Szummer in view of Linden.

(5) The rejection of claims 1-5, 9-10, 99, and 101 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Szummer in view of Uematsu.

(6) The rejection of claims 1-5, 9-10, 99, and 101 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Szummer in view of Matsui.

III. ARGUMENT

A. Rejections under 35 U.S.C. § 112, first paragraph.

Appellant respectfully submits that the rejection of claims 11, 13, 16, 18, 20-22, and 25-26 is rendered moot by the cancellation of these claims without prejudice or disclaimer in the amendment under 37 C.F.R. § 41.33(b)(1) filed on December 16, 2010.

B. Claims 99-101 are not indefinite under 35 U.S.C. § 112, second paragraph.

Claim 99 originally recited, in part (emphases added):

> wherein the electropolishing chemically modifies the at least one exposed surface of the ferritic stainless steel so that the electropolished exposed surface develops an aluminum-rich oxide scale when heated in an oxidizing atmosphere at a temperature in the range of 750°C to 850°C, aluminum-rich the oxide scale comprising iron and chromium and having a hematite structure, a_o in the range of 4.95 to 5.04 Å, and c_o in the range of 13.58 to 13.75 Å.

Appellant maintains that this language contains a clear typographical error, namely the recitation of "aluminum-rich the oxide scale comprising" should read "the aluminum-rich oxide scale comprising". In the Examiner's Answer, "the Examiner agrees that 'aluminum-rich the oxide scale comprising' would be clearer than "aluminum-rich the oxide scale comprising'." *Ex. Ans.*, p. 35. Accordingly, Appellant respectfully submits that this typographical error could be corrected with an Examiner's amendment to claim 99 so that the claim reads "the aluminum-rich oxide scale comprising."

The Examiner additionally argues "that the language in claim 99 makes it unclear as to whether the oxide scale comprises iron and chromium and then is enriched with aluminum, aluminum is present with the iron and chromium in the oxide scale or if only iron and chromium are present in the oxide scale." *Ex. Ans.*, p. 35. Appellant respectfully submits, however, that the *Specification* clearly describes the

recited oxide scale as including chromium, iron, and aluminum (*i.e.*, all three (3) elements) in the oxide scale.

Definiteness of claim language must be analyzed in light of, among other things, "the content of the particular application disclosure." *MPEP* § 2173.02. Claims 1, 10, and 99 each include the feature wherein, under certain conditions, an electropolished surface develops an aluminum-rich oxide scale comprising chromium and iron and having a hematite structure. As described in detail in the *Specification*, the distinctive oxide scale recited in the claims includes aluminum, chromium, and iron.

For example, paragraph [0058] of the *Specification* describes scanning auger microscopy analysis of the oxide scales that formed on the exposed surfaces of samples of an electropolished ferritic stainless steel heated at 750°C and 850°C. This analysis "revealed that the oxide scale is of a single phase and contains significant concentrations of aluminum, iron, and chromium...." *Specification*, ¶ [0058]. Further, "it appeared that electropolishing promotes the formation of [the] aluminum-rich oxide scale...." *Id.* Thus, aluminum is present with the iron and chromium in the oxide scale.

In addition, paragraph [0064] of the *Specification* states that "structural characterization of the thin aluminum-rich oxides formed on electropolished [ferritic stainless steel] alloy at high temperatures...confirmed that the oxides include a significant level of iron and chromium, along with aluminum...." *Id.* at ¶ [0064]. Thus, aluminum is present with the iron and chromium in the oxide scale.

The distinctive aluminum-rich oxide scale that forms on the electropolished ferritic stainless steel was shown to have a chemical composition and a crystal structure that are different than the oxide scale that formed on non-electropolished samples of an identical ferritic stainless steel. *Id.* at ¶¶ [0065]-[0068]. In fact, the aluminum-rich oxide scale comprising aluminum, chromium, and iron has a hematite crystal structure differing from Fe_2O_3, alpha Cr_2O_3, and alpha Al_2O_3. *Id.*

As is known in the art, a "hematite structure" is a trigonal-hexagonal scalenohedral crystal structure having the general chemical formula: $X_1^{[3+]}Y_1^{[3+]}O_3^{[2-]}$,

wherein the "X" and "Y" designate electropositive elements having a three electron deficient valance. The hematite crystal structure includes single metal oxides such as iron (III) oxide (Fe_2O_3), chromium (III) oxide (Cr_2O_3), and aluminum (III) oxide (Al_2O_3), which each have hematite structures that structurally differ from each other in terms of the distances between the atoms in the crystal lattice, *i.e.*, the lattice parameters a_o and c_o for the lattice unit cell. *Id.*

The distinctive oxide scale characteristic of the methods recited in the claims of the *Subject Application* is a single-phase composition having a hematite structure (*id.* at ¶ [0067]) and, therefore, may be described by the formula: $(Al,Cr,Fe)_2O_3$. The lattice parameters of the oxide scale differ from the lattice parameters of Fe_2O_3, alpha Cr_2O_3, and alpha Al_2O_3. *Id.* For example, the oxide scale may be characterized by lattice parameters a_o in the range of 4.95 Å to 5.04 Å and c_o in the range of 13.58 Å to 13.75 Å. *Id.* Indeed, the lattice parameters of the distinctive oxide scale are significantly different than the lattice parameters of Al_2O_3, Fe_2O_3, and Cr_2O_3 notwithstanding that the distinctive scale includes aluminum, iron, and chromium. *Id.* at ¶ [0068].

Clearly, the distinctive aluminum-rich oxide scale described in the *Specification* and recited in the claims includes aluminum. Therefore, Appellant respectfully requests reversal of the rejection of claims 99-101 under 35 U.S.C. § 112, second paragraph.

C. Claims 1-5, 9-10, and 99-101 are patentable under 35 U.S.C. § 103(a).

1. The Examiner's reliance on both optimization and inherency is improper under both the MPEP and the controlling case law.

Throughout the Examiner's Answer, the Examiner relies on MPEP § 2112.01 in support of the obviousness rejections. Section 2112.01 of the MPEP describes case law that stands for the proposition that products having the same

composition and the same structure exhibit the same properties. *See MPEP* § 2112.01, which states:

> Where the claimed and prior art products are **identical** or **substantially identical** in structure or composition, or are produced by **identical** or **substantially identical** processes, a prima facie case of either anticipation or obviousness has been established. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977).
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> 'Products of **identical** chemical composition can not have mutually exclusive properties.' A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the **identical** chemical structure, the properties applicant discloses and/or claims are necessarily present. *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990) (Applicant argued that the claimed composition was a pressure sensitive adhesive containing a tacky polymer while the product of the reference was hard and abrasion resistant. 'The Board correctly found that the virtual **identity** of monomers and procedures sufficed to support a prima facie case of unpatentability of Spada's polymer latexes for lack of novelty.').
>
> (Emphases added)

Thus, the MPEP and the case law cited therein provide that identical or substantially identical compositions and products necessarily have the same properties. However, this principle is not applicable to the present case because the cited art does not disclose compositions or products that are identical or substantially identical to those produced according to the methods recited in the subject claims. Rather, the rejections under appeal are based on the combination, modification, and optimization of various prior art teachings.

Here, the cited art is silent regarding the aluminum-rich hematite oxide scale recited in the subject claims. The cited art is also silent regarding any relationship between electropolishing and improved oxidation resistance. Indeed, the cited art is silent regarding the electrochemical modification of the surfaces of ferritic stainless steels containing controlled levels of aluminum and rare earth metals. Therefore, the cited art does not describe identical or substantially identical methods or products.

In contrast, the Examiner refers to the cited art as teaching various discrete features, which the Examiner cherry-picks, combines, modifies, and optimizes in an attempt to re-create the methods recited in the subject claims. Even in this manner, however, the Examiner has failed to find a reference that teaches or suggests a relationship between electropolishing and improved high temperature oxidation resistance, or the aluminum-rich oxide scale comprising aluminum, iron, and chromium, and having a hematite structure that develops on electrochemically modified surfaces, as recited in the subject claims. Rather, the Examiner states that these would be inherent features of a theoretical method created by combining various discrete features from the cited references.

Thus, the Examiner's rejections rely on an asserted **optimization** of the teachings presented in the cited art. *See MPEP* § 2144.05. However, as stated in MPEP § 2112.IV (emphases added):

> The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (**reversed** rejection because **inherency** was based on what would result due to **optimization** of conditions, not what was necessarily present in the prior art)....
>
> (Emphases added)

Thus, the Court in the *Rijckaert* case reversed the examiner's rejection because, as is the case here, the alleged inherent features were based on "what would result due to **optimization** of conditions, not [on] what was necessarily present in the prior art."

The Court of Appeals for the Federal Circuit and the MPEP both recognize that obviousness rejections cannot be based on the alleged inherent features that "would result due to optimization of conditions." Nevertheless, the Examiner maintains his rejections based on a combination of modified and optimized reference teachings and alleged inherent features. **Therefore, the Examiner's obviousness rejections are without legal basis and must be reversed**.

The Examiner further states that he interprets the language of the subject claims reciting the aluminum-rich hematite oxide scale as "optional language in accordance with MPEP § 2111.04." *Ex. Ans.*, p. 38 and 40. Appellant respectfully disputes the Examiner's interpretation of this language as optional.

As stated in MPEP § 2111.04, "[c]laim scope is not limited by claim language that suggests or makes optional but does not require steps to be performed, or by claim language that does not limit a claim to a particular structure." While a high temperature exposure step is not affirmatively recited in the subject claims, the claim language does, in fact, affirmatively characterize the electrochemical modification that occurs during the electropolishing. Therefore, this claim language does limit the claims to a particular structure.

The electrochemical modification is not optional. The electrochemical modification must occur in order to develop the aluminum-rich hematite oxide scale, which provides the increased oxidation resistance. In fact, Example 2 in the *Specification* shows that increased high temperature oxidation resistance is achieved through the development of the aluminum-rich hematite oxide scale, which is "unique to a surface having a **structure** produced by electrochemical modification, such as by electropolishing; [where] mechanical polishing to a specular finish does not produce like results, and lightly polishing an electropolished surface to thereby remove the modified surface layer reverses the improvement in oxidation resistance." *Specification*, ¶ [0063], emphasis added. Thus, the language of the subject claims reciting the aluminum-rich hematite oxide scale is not optional because it characterizes the electrochemical modification resulting from the electropolishing.

The MPEP and the case law cited therein provide that "[o]bviousness cannot be predicated on what is not known at the time an invention is made, even if the inherency of a certain feature is later established." *Rijckaert*, 9 F.2d at 1534, *cited in MPEP* § 2141.02.V. Appellant respectfully submits that the *Rijckaert* case is controlling in the present case, holding that "the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that

result or characteristic." *MPEP* § 2112.IV. The Court of Appeals for the Federal Circuit in the *Rijckaert* case stated, as a matter of law, that "a retrospective view of inherency is not a substitute for some teaching or suggestion supporting an obviousness rejection." *Rijckaert*, 9 F.2d at 1534. The Court held that obviousness cannot be shown based on what is not known in the prior art at the time an invention is made, even if the inherency of a certain feature is later established. *Id.* Here, the aluminum-rich hematite oxide scale, the relationship between electropolishing and improved oxidation resistance, and the electrochemical modification of the surfaces of ferritic stainless steels containing controlled levels of aluminum and rare earth metals, as described in the *Specification* and recited in the subject claims, where apparently not known in the prior art at the time the invention is made.

The cases cited in MPEP § 2112.02 support the use of inherency when the cited prior art teaches products that are **identical** (under § 102) or **substantially identical** (under § 103) in structure or composition to the claims in a patent application, *i.e.*, where the prior art does not require modification or optimization. In such situations, inherency can be used to support a *prima facie* case of anticipation because a single prior art reference discloses a product having each and every structural or compositional feature as a technological fact and, therefore, the reference **necessarily** possesses the alleged inherent features. Further, a *prima facie* case of obviousness may be based on a **single** prior art reference that teaches or suggests each and every structural or compositional feature as a technological fact even if the reference does not expressly disclose certain properties or functional features. This is because the substantial identity of structural and compositional features necessarily suggests the missing descriptive matter. However, inherency cannot be used to remedy the lack of a teaching or suggestion of certain features when the prior art requires modification and optimization and, therefore, does not describe identical or substantially identical products. Therefore, MPEP § 2112 and the cases cited therein are inapplicable where, as here, the Examiner attempts to re-create the subject claims by combining, modifying, and optimizing multiple discrete reference teachings.

2. Applicant has provided sufficient evidence of unexpected results.

The Examiner argues that Applicant has failed to show unexpected results with regard to the 0.2 to 1.0 weight percent aluminum and the 0.02 to 1.0 weight percent total rare earth metal(s), stating that "Appellants should compare a sufficient number of tests both inside and outside the claimed range to show the criticality of the claimed range. MPEP § 716.02(d)(II)." *Ex. Ans.*, pp. 40 and 55-60. Here, the Examiner confuses criticality of ranges with unexpected results generally.

The presence of a property not possessed by the prior art is evidence of non-obviousness. *MPEP* § 716.02(a), *citing In re Papesch*, 315 F.2d 381, 137 USPQ 43 (CCPA 1963); *Ex parte Thumm*, 132 USPQ 66 (Bd. App. 1961). There is no disclosure in the cited art that suggest a relationship between improved high temperature oxidation resistance properties due to an aluminum-rich hematite oxide and electropolishing ferritic stainless steels having controlled levels of aluminum and rare earth metals. The Examiner does not appear to dispute this fact, given his reliance on optimization and inherency throughout the Examiner's Answer.

A previously unknown relationship between improved high temperature oxidation resistance properties due to an aluminum-rich hematite oxide and electropolishing ferritic stainless steels having controlled levels of aluminum and rare earth metals is shown in the *Specification* and is recited in the subject claims. Furthermore, the Brady Declaration provides uncontroverted expert testimony that a person skilled in the art would not have expected the results described in the *Specification* and recited in the subject claims. *See Brady Declaration*[1]. Therefore, the Examiner's insistence that Applicant has failed to show unexpected results is incorrect as a factual matter.

Regarding the evidentiary standard for the obviousness inquiry, Appellant notes that the determination of patentability is made based on a preponderance of the

[1] The Declaration of Michael P. Brady, Ph.D., submitted August 23, 2007.

evidence. *In re Oetiker*, 977 F.2d 1443 (Fed. Cir. 1992). Further, the determination of patentability must be made based on the totality of the evidence as a whole, not on the ability of each argument and piece of evidence to knock down any alleged *prima facie* case. *In re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); MPEP § 716.01(d). The ultimate determination of patentability must be based on consideration of the entire record, by a preponderance of evidence, with due consideration to the persuasiveness of any arguments and any additional evidence, including testimonial evidence. *Oetiker*, 977 F.2d 1443. Facts established by rebuttal evidence must be evaluated along with the facts on which the conclusion of a *prima facie* case was reached, not against the conclusion itself. *In re Eli Lilly*, 902 F.2d 943, 14 USPQ2d 1741 (Fed. Cir. 1990).

Moreover, the Examiner has not explained why the testing data presented in the Specification (pp. 22-37, FIGS. 2-13) is insufficient under MPEP § 716.02(d)(II), considering that the cited references are silent regarding any relationship between aluminum content, rare earth content, electropolishing, oxide surface scale formation, and high temperature oxidation resistance. Appellant respectfully submits that the testing data presented in the *Specification* is sufficient to show unexpected results relative to the cited art, particularly in view of the expert opinion testimony provided in the Brady Declaration.

3. Declaration of Michael P. Brady, Ph.D. under 37 C.F.R. § 1.132.

On pages 60-64 of the Examiner's Answer, the Examiner provides a number of inaccurate statements regarding the Brady Declaration that Appellant addresses below.

The Examiner states "that the formation of the aluminum-rich oxide scale on the surface of the ferritic stainless steel is optional because Appellant does not claim the active step of subjecting the steel to a high temperature oxidizing atmosphere and therefore, the Declaration is not commensurate in scope with the claims...." *Ex. Ans.*, p.

61. As discussed above, while a high temperature exposure step is not affirmatively recited in the subject claims, the capability of forming the scale under high temperature oxidizing conditions does, in fact, affirmatively characterize the electrochemical modification that occurs during the electropolishing. The electrochemical modification is not optional. The electrochemical modification must occur in order to develop the aluminum-rich hematite oxide scale, which provides the increased oxidation resistance. In fact, Example 2 in the *Specification* shows that improved high temperature oxidation resistance is achieved through the development of the aluminum-rich hematite oxide scale, which is "unique to a surface having a **structure** produced by electrochemical modification, such as by electropolishing; [where] mechanical polishing to a specular finish does not produce like results, and lightly polishing an electropolished surface to thereby remove the modified surface layer reverses the improvement in oxidation resistance." *Specification*, ¶ [0063], emphasis added. Thus, the Examiner's statement is incorrect.

The Examiner states that "the Declaration is not persuasive because it fails to set forth evidence to substantiate the conclusory statements set forth therein." *Ex. Ans.*, p. 61. The Brady Declaration presents testimonial opinion evidence of an independent expert in the art. The Examiner has provided no evidence that calls into question the accuracy of the statements presented in the Brady Declaration. Therefore, the statements are uncontroverted. Further, the Examiner has provided no explanation or argument that would tend to impeach the expert opinion provided by the testimonial evidence presented in the Brady Declaration. Because the Examiner did not produce any countervailing evidence that indicates the statements presented in the Brady Declaration are inaccurate, no substantiation or corroboration is required. The Brady Declaration is entitled to appropriate weight as evidence of what a person skilled in the art would have understood and believed at the time the invention was made. Further, the Brady Declaration is entitled to appropriate weight as evidence that a person skilled in the art would have found the results described in the *Specification* and recited in the subject claims to be unexpected given the state of the art at the time the invention was made.

The Examiner dismisses the documents cited in the Brady Declaration because the documents discuss nickel and titanium alloys whereas the subject claims recite stainless steels. *Ex. Ans.*, p. 61. However, the Examiner has provided no evidence or technical reasoning that calls into question or otherwise impeaches Dr. Brady's expert opinion that those skilled in the metallurgical arts believed that roughening a metallic surface generally improved oxidation resistance. Dr. Brady's expert testimony indicates that the facts shown in the cited documents relating to nickel and titanium alloys were believed to be applicable to stainless steels as well. Dr. Brady is a qualified expert in the field of oxidation, corrosion, and metallic alloy design (*Brady Declaration,* ¶¶ 4-7), and if the Examiner purports to impeach Dr. Brady's testimony, the Examiner must show that Dr. Brady's statements are inaccurate. The Examiner has failed to do so.

4. The statements regarding Ishibashi in the Examiner's Answer are incorrect.

The Examiner argues that "if both Ishibashi ('311) and the instant invention have an oxide film then both would be capable of forming the [oxide scale] as claimed." *Ex. Ans.*, p. 36. This is incorrect because the oxide coating in Ishibashi is explicitly described as lacking aluminum and having a spinel crystal structure, whereas the oxide scale recited in the claims of the *Subject Application* is aluminum-rich and has a hematite crystal structure. Thus, Ishibashi explicitly teaches a chemically and structurally different oxide scale that would **preclude** the development of the aluminum-rich hematite oxide scale recited in the claims of the *Subject Application.*

The aluminum-rich oxide scale comprising aluminum, chromium, and iron that develops in high temperature oxidizing atmospheres according to the subject claims has a hematite crystal structure, *i.e.*, $(Al,Cr,Fe)_2O_3$.

In contrast, Ishibashi teaches an oxide coating, which is described as follows:

> Said metal oxide coming from the stainless steel consists of those having the chemical formula of FeO $(FeCr)_2O_3$ in the ferritic stainless steel and (Fe, Ni) O $(Fe.Cr)_2O_3$ in the austenitic stainless steel, the both metal oxides being the spinel structure having the lattice defect.

Ishibashi, c. 5, ll. 14-19. These metal oxides do **not** include aluminum at all, let alone being aluminum-rich, as recited in the subject claims. Further, Ishibashi discloses that these metal oxides have a **spinel** crystal structure, not a **hematite** crystal structure, as recited in the subject claims. A spinel crystal structure has the general formula:[2] $A_1^{[2+]}B_2^{[3+]}O_4^{[2-]}$, in contrast to the hematite crystal structure formula: $X_1^{[3+]}Y_1^{[3+]}O_3^{[2-]}$.

Accordingly, the oxide scale recited in the subject claims is compositionally and structurally different than and distinct from the oxides disclosed in Ishibashi. There is no disclosure presented in Ishibashi that teaches or suggests aluminum-rich oxides or hematite crystal structures, as recited in the subject claims. Furthermore, an aluminum-rich hematite oxide scale cannot be inherent in the teachings of Ishibashi because the material disclosed in Ishibashi would already have a chemically and structurally different oxide on the surface of the material.

Moreover, Ishibashi discloses aluminum and the rare earth metal yttrium among an unspecific and undifferentiated list of thirteen alloying elements that may be present in stainless steels in concentrations ranging from 0.001 to 5.00 weight percent. *Ishibashi*, c. 3, ll. 61-62 and c. 4, ll. 15-16, reproduced below (emphases added).

[2] The spinel oxide disclosed in Ishibashi satisfies this formula, wherein A = Fe^{2+} and B = $(FeCr)^{3+}$.

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Another one of the metal compositions used in the present invention is the stainless steel having low carbon content compounding other metal to improve the anticorrosion, the formability and the weldability, for example, 0.001 - 0.15 wt % of C, 0.005 - 3.00 wt % of Si, 0.005 - 10.00 wt % of Mn, 11.00 - 30.00 wt % of Cr and 0.001 - 5.00 wt % of at least one of element(s) selected from the group of N, Cu, Al, V, Y, Ti, Nb, Ta, U, Th, W, Zr and Hf, optionally, 0.75 - 5.00 wt % of Mo and the balance being of Fe, Me/C + N ratio being more than 5.0, while said ratio being more than 8.0 in the stainless steel comprising Nb, Ta, or Ti as the additional element.

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Further another one of the metal compositions used in the present invention is the stainless steel having low carbon content compounding other metal to improve tha anticorrosion, the formability and the weldability, for example 0.001 - 0.15 wt % of C, 0.005 - 3.00 wt % of Si, 0.005 - 10.00 wt % of Mn, 0.005 - 22.00 wt % of Ni, 11.00 - 30.00 wt % of Cr and 0.001 - 5.00 wt % of at least one of element(s) selected from the group of N, Cu, Al, V, Y, Ti, Nb, Ta, U, Th, W, Zr and HF, optionally, 0.75-5.00 wt % of Mo and the balance being of Fe, Me/C + N ratio being more than 5.0, while said ratio being more than 8.0 in the stainless steel comprising Nb, Ta, or Ti as the additional element.

In contrast, the present inventor discovered that an aluminum-rich oxide scale comprising aluminum, chromium, and iron, and having a particular hematite structure, will develop on an electropolished surface of certain ferritic stainless steels when subjected to a high temperature oxidizing atmosphere, provided that the ferritic stainless steel contains 0.2 to 1.0 weight percent aluminum and 0.02 to 1.0 weight percent total rare earth metal(s). *Specification*, ¶¶ [0045] and [0052]-[0073]. The Examiner contends that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected the claimed amounts of aluminum and yttrium from the amount disclosed in Ishibashi. *See Ex. Ans.*, p. 6. Thus, the Examiner's rejections rely on an asserted **optimization** of the teachings presented in Ishibashi. *See MPEP* § 2144.05. As discussed above, the MPEP and the controlling *Rijckaert* case hold that obviousness rejections cannot be based on the alleged inherent features that "would result due to optimization of conditions."

There is no disclosure in Ishibashi related to electrochemical modification of ferritic stainless steels, let alone ferritic stainless steels limited to 0.2 to 1.0 weight percent aluminum and 0.02 to 1.0 weight percent total rare earth metal(s). The Examiner's obviousness argument is based on a modification and **optimization** of the teachings presented in Ishibashi. Ishibashi does **not** teach an identical or substantially identical article or processing method. Therefore, the Examiner has not established a *prima facie* case of obviousness. *Rijckaert*, 9 F.3d at 1534; MPEP §§ 2112.IV; 2112.01; 2141.02.V; and 2144.05 (case law citations omitted).

The Examiner argues that even if an electropolished surface of Ishibashi is never exposed to an oxidizing atmosphere at high temperature, the aluminum-rich hematite oxide scale would be expected to develop if the surface were to ever be so exposed. *Ex. Ans.*, p. 36. This is incorrect because the aluminum-free spinel oxide scale explicitly taught in Ishibashi would physically block any chemical reaction between the underlying steel alloy and an oxidizing atmosphere. Moreover, a person skilled in the art would **expect** an oxidizing atmosphere to further the formation of the aluminum-free spinel oxide scale actually taught in Ishibashi. A person skilled in art would not **expect** the development of a previously unknown oxide scale having a chemical composition and crystal structure different than any known oxides. Indeed, given the lack of information in Ishibashi regarding electrochemical surface modification and oxide scale formation, a person skilled in the art would not have any expectation, let alone a reasonable expectation, of successfully achieving a previously unknown oxide scale under high temperature oxidizing conditions. *See MPEP* § 2143.02 (reasonable expectation of success is required).

Thus, the Examiner's arguments on pages 38-40 of the Examiner's Answer are incorrect because: (1) Ishibashi does not disclose substantially the same composition and processing, but rather requires modification and optimization; and (2) the improvement in oxidation resistance, which is characterized by the aluminum-rich hematite oxide scale development under high temperature oxidizing conditions, is not optional.

The Examiner's Answer also states:

> ... that 'Ishibashi discloses the same utility throughout the disclosed ranges' is in reference to the electropolishing of a ferritic stainless steel which is disclosed in Ishibashi ('311) and the instant invention and not with regard to the specific utility of the elements of aluminum and yttrium.

Ex. Ans., p. 41. Appellant respectfully submits that this asserted rebuttal argument does not make technological sense.

The Examiner initially asserts that:

> It would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected [the 0.2 to 1.0 weight percent aluminum and the 0.02 to 1.0 weight percent total one rare earth metal(s)] from the [0.001 to 5.00 weight percent aluminum and yttrium] disclosed by Ishibashi ('311) because Ishibashi ('311) discloses the same utility throughout the disclosed ranges.

Ex. Ans., p. 6. Thus, the Examiner initially argued that it would have been obvious to select aluminum and yttrium sub-ranges because Ishibashi discloses the same utility for these elements as described in the *Subject Application*. Now the Examiner argues that the "same utility" refers to "the electropolishing of a ferritic stainless steel in Ishibashi." However, Ishibashi does not teach or suggest any technological relationship, let alone a common utility, between electropolishing a ferritic stainless steel and the aluminum and yttrium content o a ferritic stainless steel. Without any technological relationship, it would not have been obvious to select particular narrow sub-ranges from the broad ranges disclosed in Ishibashi. There would not be any technological criteria that a person skilled in the art could use to select sub-ranges, as alleged by the Examiner.

In the Appeal Brief, Appellant argued that, in fact, Ishibashi does not identify a specific utility for aluminum and yttrium, let alone the same utility as described in the *Specification*. This remains true. Ishibashi merely discloses aluminum and yttrium among an unspecific and undifferentiated list of thirteen alloying elements (N, Cu, Al, V, Y, Ti, Nb, Ta, U, Th, W, Zr, and Hf) that may be present in stainless steels in concentrations ranging from 0.001 to 5.00 weight percent. *Ishibashi*, c. 3, ll. 61-62 and c. 4, ll. 15-16. Therefore, the Examiner's assertion that Ishibashi "discloses the same utility throughout the disclosed ranges" is incorrect because Ishibashi does not even suggest that certain narrow concentrations of these elements, or electropolishing, are necessary for the development of certain oxide scales on surfaces exposed to high temperature oxidizing atmospheres.

The Examiner also points out that the subject claims are broad because the "comprising language" is open-ended, thus allowing other alloying elements in the recited ferritic stainless steel. However, that does not change the fact that Ishibashi

fails to disclose any technical information that a person skilled in the art could have used to select sub-ranges for aluminum and yttrium that are productive of the unexpected results described in the *Specification* and recited in the subject claims.

The chemistry of the stainless steel compositions disclosed in Ishibashi is broad. Indeed, Ishibashi expressly acknowledges that the disclosed stainless steels may be either ferritic or austenitic. *Ishibashi*, c.3, ll.50-54. There is no disclosure in Ishibashi that would lead a person skilled in the art to experiment, optimize, or otherwise determine the ranges for aluminum and rare earth elements recited in the subject claims.

The Examiner maintains his reliance on MPEP § 2144.05 a basis for the § 103(a) rejections. *Ex. Ans.*, p. 45. Contrary to the statement in the Examiner's Answer, Appellant recognizes that MPEP § 2144.05 states that "a *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties." However, there is no disclosure presented in Ishibashi that would provide a person skilled in the art with an expectation of the properties described in the *Specification* and recited in the subject claims. Indeed, a person skilled in the art considering Ishibashi would have expected the oxides and properties disclosed in Ishibashi, not the previously unknown oxides and properties described in the *Specification* and recited in the subject claims. Thus, a *prima facie* case of obviousness does not exist.

Again, contrary to the statement in the Examiner's Answer, Appellant also recognizes that "[t]he normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages." *In re Peterson*, 315 F.3d 1325, 1330, (Fed. Cir. 2003), *cited in MPEP* § 2144.05.II.A (Optimization Within

Prior Art Conditions or Through Routine Experimentation).[3] However, only result-effective variables can be optimized. *MPEP* § 2144.05.II.B.

There is no suggestion in Ishibashi that aluminum and yttrium concentration correlate to any recognized result that may be optimized, let alone correlating aluminum and yttrium concentration to oxidation resistance and the development of a distinctive oxide scale on electropolished surfaces under oxidizing conditions. As stated in MPEP § 2144.05(II)(B), "[a] particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." Therefore, the Examiner's optimization argument is improper because Ishibashi does not recognize aluminum and yttrium concentrations as achieving any recognized result. Thus, a person skilled in the art would not have any technological basis to perform the optimization asserted by the Examiner to arrive at the methods recited in the subject claims.

The Examiner asserts that Ishibashi discloses that elements such as aluminum and yttrium improve corrosion resistance at column 3, lines 55-69. *Ex. Ans.*, p. 46. Appellant respectfully submits that column 3, lines 55-69 of Ishibashi discloses that carbon, silicon, manganese, chromium, nitrogen, copper, aluminum, vanadium, yttrium, titanium, niobium, tantalum, uranium, thorium, tungsten, zirconium, and hafnium, in various broad concentrations, "improve the anticorrosion, the formability and the weldability" of stainless steel. A person skilled in the art would readily understand that these thirteen elements would not all have the same metallurgical effect, let alone all "improve the anticorrosion, the formability and the weldability" of stainless steel. Accordingly, this disclosure does not provide any technological basis to perform the optimization asserted by the Examiner to arrive at the methods recited in the subject claims.

[3] Clearly, the Examiner is again relying on both optimization and inherency in an attempt to establish a *prima facie* case of obviousness, which the Rijckaert case holds is improper. *MPEP* § 2112.IV.

5. The statements regarding Szummer, Ono, Linden, Uematsu, and Matsui in the Examiner's Answer are also incorrect.

Like the rejections based on Ishibashi discussed above, the Examiner relies on a combination of inherency arguments under MPEP § 2112, and optimization arguments under MPEP § 2144.05, in support of the obviousness rejections based on Szummer in view of Ono, Linden, Uematsu, or Matsui. But, as discussed above, the MPEP and the controlling *Rijckaert* case hold that obviousness rejections cannot be based on the alleged inherent features that "would result due to optimization of conditions." *MPEP* § 2112.IV.

Further, Appellant maintains that the range of aluminum disclosed in Linden does not overlap with any of the aluminum concentration ranges recited in the subject claims, and the range of aluminum disclosed in Uematsu does not overlap with the aluminum concentration range recited in independent claim 99. The Examiner argues that Linden discloses an alloy having 0.49 percent aluminum. *Ex. Ans.*, p. 49 (*citing Linden*, p. 9, Table 1, alloy B). However, this alloy contains zero rare earth metals and, therefore, is irrelevant with respect to the alloys recited in the subject claims. Further, the Examiner argues that the aluminum content would be result-effective in terms of the workability of the alloy. *Ex. Ans.*, p. 49-50 (*citing Linden*, p. 7; *MPEP* § 2144.05.II).

Firstly, optimization of aluminum content to achieve optimal workability would not necessarily result in aluminum content that achieves improved high temperature corrosion resistance due to the formation of a hematite oxide scale comprising aluminum, chromium, and iron. This is so because improved workability and improved corrosion resistance are two different results that are not commonly correlated to aluminum content as a single result-effective variable. Indeed, Linden teaches that increasing aluminum content increases corrosion resistance, but also decreases workability. *Linden*, p. 7, ll. 4-5.

Secondly, Linden discloses that "more than 3% aluminum is **required** in order to form a covering **aluminum oxide** [*i.e.*, Al_2O_3] on the material." *Linden*, p. 7, ll. 4-5, emphases added. Thus, Linden teaches away from 0.2 to 1.0 percent aluminum, and further teaches the formation of a chemically and structurally different surface oxide than that recited in the subject claims.

Examiner argues that Uematsu discloses an alloy having 0.81 percent aluminum (alloy 12 in Table 2). *Ex. Ans.*, p. 50. The Examiner argues that 0.81 percent aluminum is close enough to the 0.4 to 0.8 weight percent aluminum recited in claim 99 to establish a *prima facie* case of obviousness. *Id.* However, the Examiner does not explain why that is so, especially considering that Uematsu, like Linden, teaches the formation of an aluminum oxide (Al_2O_3) layer on the material. *Uematsu*, ¶ [0013]. Thus, Uematsu also teaches the formation of a chemically and structurally different surface oxide than that recited in the subject claims.

Indeed, all of the secondary references teach the formation of oxide films that are chemically and structurally different than the aluminum-rich hematite oxide scale recited in the subject claims. *See Linden*, p. 7, ll. 4-5; *Uematsu*, ¶ [0013]; *Ono*, ¶¶ [0012], [0016], and [0019]; *Matsui*, ¶ [0018]. As a result, a person skilled in the art considering Szummer and the secondary references, collectively, would not have a reasonable expectation of successfully achieving the previously unknown oxide scale under high temperature oxidizing conditions. *See MPEP* § 2143.02 (reasonable expectation of success is required).

Further, as discussed in the appeal brief, Szummer describes using electropolishing to prepare ferritic stainless steel specimens for studying the "surface microstructure of ferritic chromium stainless steels subjected to hydrogen charging". *Szummer*, abstract. Electropolishing is used in Szummer to provide a smooth, reflective, and oxide-free alloy surface that is hydrogen-charged to study the effects of the hydrogen charging on the microstructure of the alloy material. *Id.* at p. 356, c. 2. Indeed, Szummer expressly states that the hydrogen-charged surfaces of the specimens were "left unaffected by the preparation procedure so that the hydrogen-

induced microstructural changes in the sample surface zones could be examined." *Id.* Thus, the purpose of the study described in Szummer was to investigate the microstructure of hydrogen-charged metallic alloy.

Appellant maintains that the Examiner's asserted reasons for combining Szummer with the secondary references, and modifying/optimizing the chemical composition of the alloy described in Szummer, are inconsistent with the study disclosed in Szummer. The Examiner asserts that it would have been obvious to add aluminum and rare earth metals, as disclosed in the secondary references, to the stainless steel disclosed in Szummer, in order to:

- ...improve oxidation (corrosion) resistance, as disclosed by Ono...;
- ...form a protective oxide layer and improve adhesion of the oxide layer, as disclosed by Linden...;
- ...maintain high temperature oxidation resistance and improve adhesion of the oxide film, as disclosed by Uematsu...; and
- ...maintain high temperature oxidation resistance and improve adhesion of the oxide film, as disclosed by Matsui....

Ex. Ans, pp. 10, 16, 21, and 26, respectively. However, these asserted reasons for the Examiner's proposed combination, modification, and optimization are inconsistent with the explicit disclosure in Szummer that the hydrogen-charged surfaces of the specimens were "left unaffected by the preparation procedure so that the H-induced microstructural changes in the sample surface zones could be examined."

The secondary references recognize that aluminum increases corrosion resistance by causing the formation of aluminum oxide layers on the surface of stainless steels. *Linden*, p. 7, ll. 4-5; *Uematsu*, ¶ [0013]; *Ono*, ¶ [0019]; *Matsui*, ¶ [0018]. Nevertheless, the Examiner asserts that "the presence of a surface with minimal corrosion due to the presence of aluminum prior to mechanically polishing and electropolishing would be easier to process/investigate than a surface with greater than minimal corrosion due to the lack of elements providing oxidation resistance." *Ex. Ans.*, pp. 50-51. This statement is technologically inconsistent because the secondary

references teach improved corrosion resistance due to the formation of aluminum oxide on the surface of the stainless steels. A person skilled in the art investigating hydrogen-induced microstructural changes in **metallic** surfaces (as disclosed in Szummer) would not have any reason to modify the chemical composition of the samples to form aluminum oxides (*i.e.*, **ceramic** materials) on the surfaces of the samples (as disclosed in the secondary references). Therefore, the Examiner's reasons for combining Szummer with the secondary references are mere conclusory statements that are technologically inconsistent with the teachings of Szummer and, therefore, cannot establish *prima facie* cases of obviousness. *See Ex Parte Linzer*, Appeal 2009-001858, *6 (BPAI May 28, 2010) (citing *In re Kahn*, 441 F.3d 977, 998 (Fed. Cir. 2006), quoted in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007)).

The Examiner also asserts that "the presence of a corroded surface would negatively impact the microhardness of that surface, thus compromising the results of the study since the study investigates the effect of hydrogen upon microhardness." *Ex. Ans.*, pp. 50-52. However, Szummer discloses the use of mechanical polishing and electropolishing for the conventional purpose of providing metallic surfaces free of oxidation products and other surface layers. *See App. Br.*, § VII.C.3.iii, p. 45 (explaining the use of polishing techniques in Szummer to provide metal alloy surfaces for hydrogen-charging). A person skilled in the art considering Szummer and the secondary references, collectively, would not add aluminum, which is taught in the secondary references as forming aluminum oxide (*i.e.*, ceramic) surface layers, in an attempt to improve a metallographic study of the surface microstructure of metallic alloy.

Appellant maintains that there is no advantage to improving the high temperature oxidation resistance of the specimens studied in Szummer by adding aluminum because the purpose of the study is to investigate the effects of hydrogen charging of polished surfaces. Indeed, Appellant submits that modifying Szummer as asserted by the Examiner would introduce additional variables into the disclosed study, which could confound the variables investigated in the study. A person skilled in the art

would not add additional and unnecessary variability into a controlled study. The Examiner has not provided a coherent rebuttal to this argument.

IV. CONCLUSION

For the reasons discussed above, and in the Appeal Brief filed on August 26, 2010 and the Supplemental Appeal Brief filed on September 20, 2010, Appellant respectfully asks the Board to reverse all rejections of the subject claims.

Respectfully submitted,

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Date

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